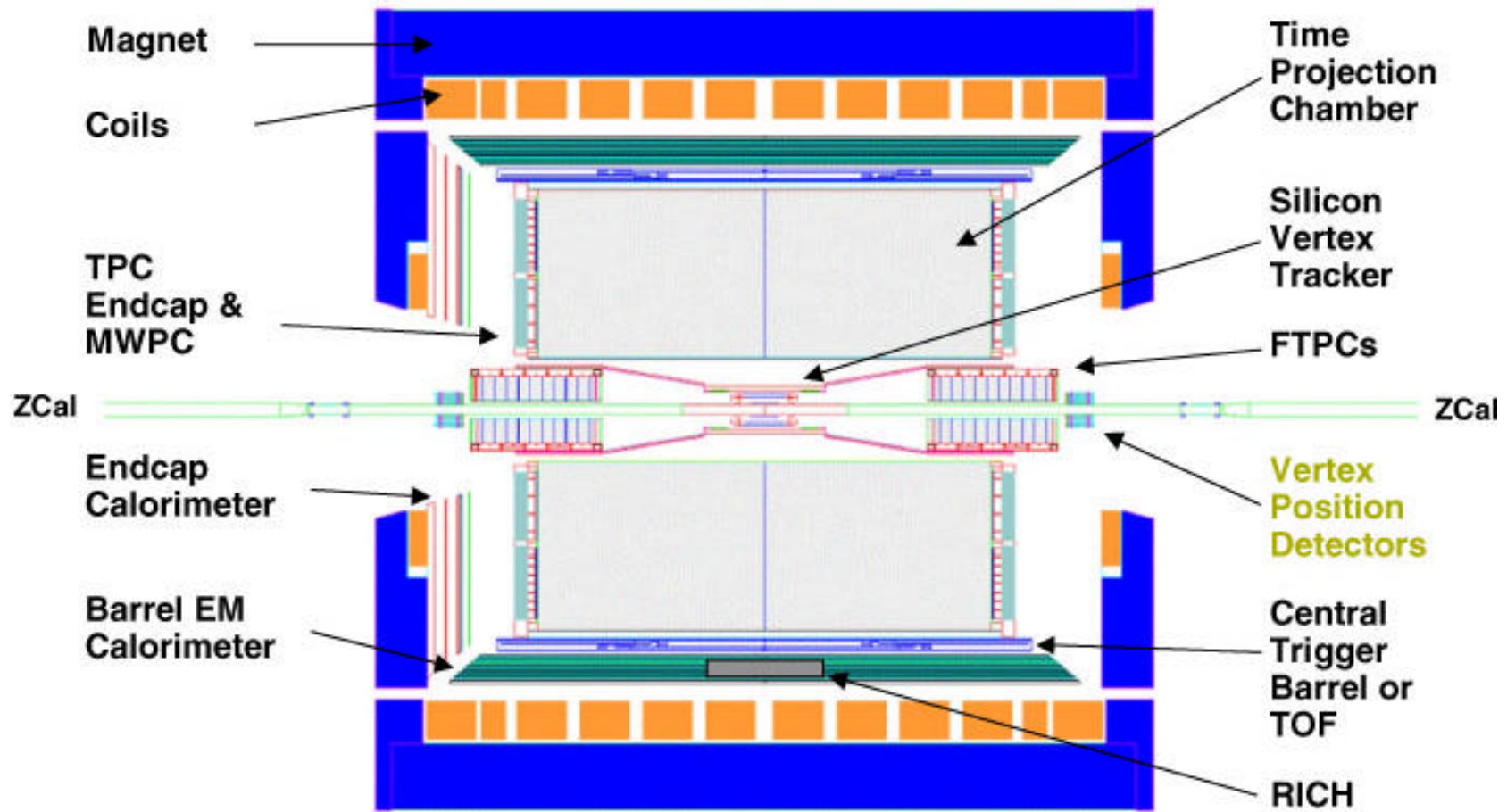




STAR Trigger System

- Requirements
- Implementation
- Performance during Summer 2000 Gold-Gold Running

STAR Detector System



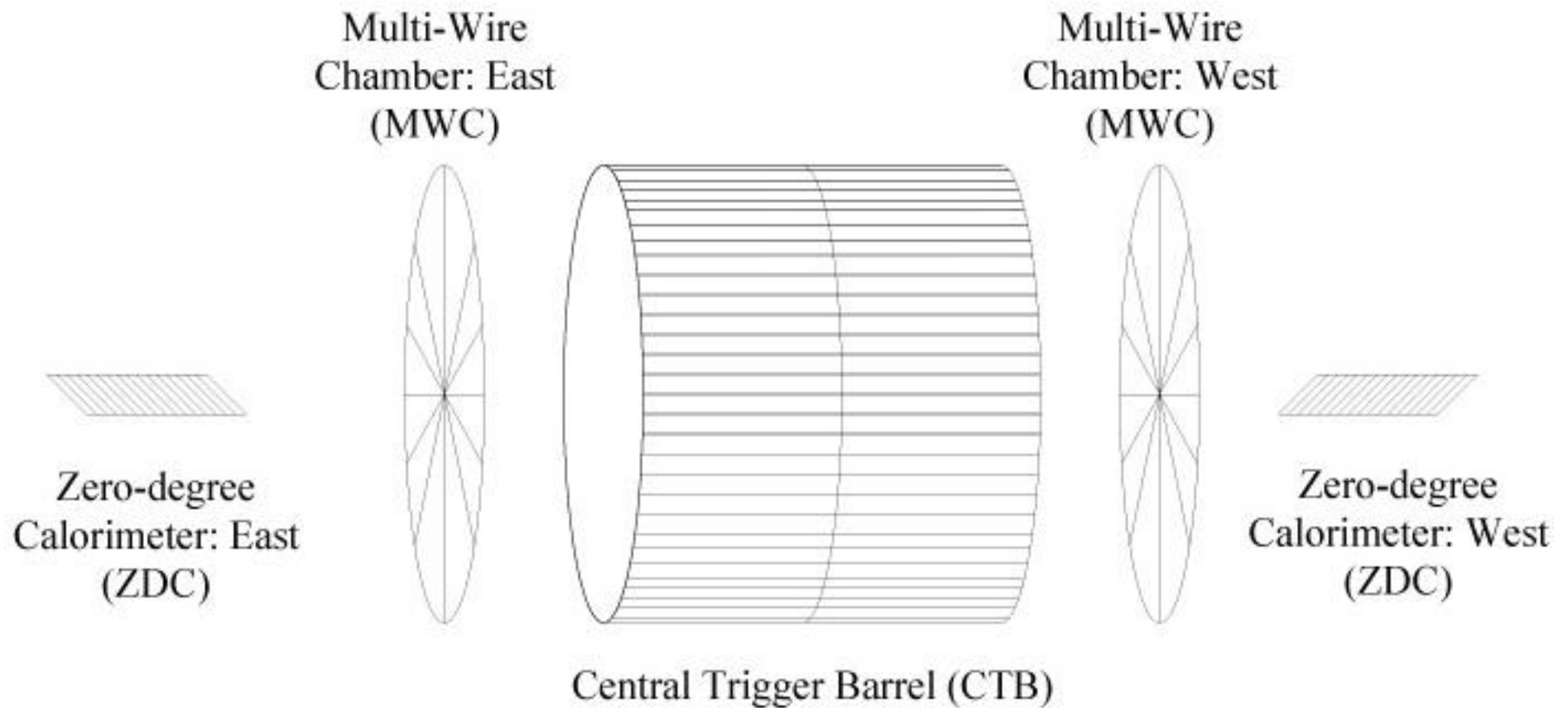
Picture provided by J.H. Thomas

Requirements for Triggering



- Look at **EVERY** RHIC bunch crossing
- **Physics**
 - Multiplicity greater than threshold value
 - ZDCs (East and West) see at least one neutron each
 - Abort if further analysis shows the event is **NOT** really interesting
- **Calibrations**
 - Laser and Pulser ...
 - On demand or automatically
- **Mechanics**
 - Detectors and DAQ alive
 - Issue triggers within 1.4 ms of the interaction
 - Blue and Yellow Ring bunches filled

Trigger Detectors

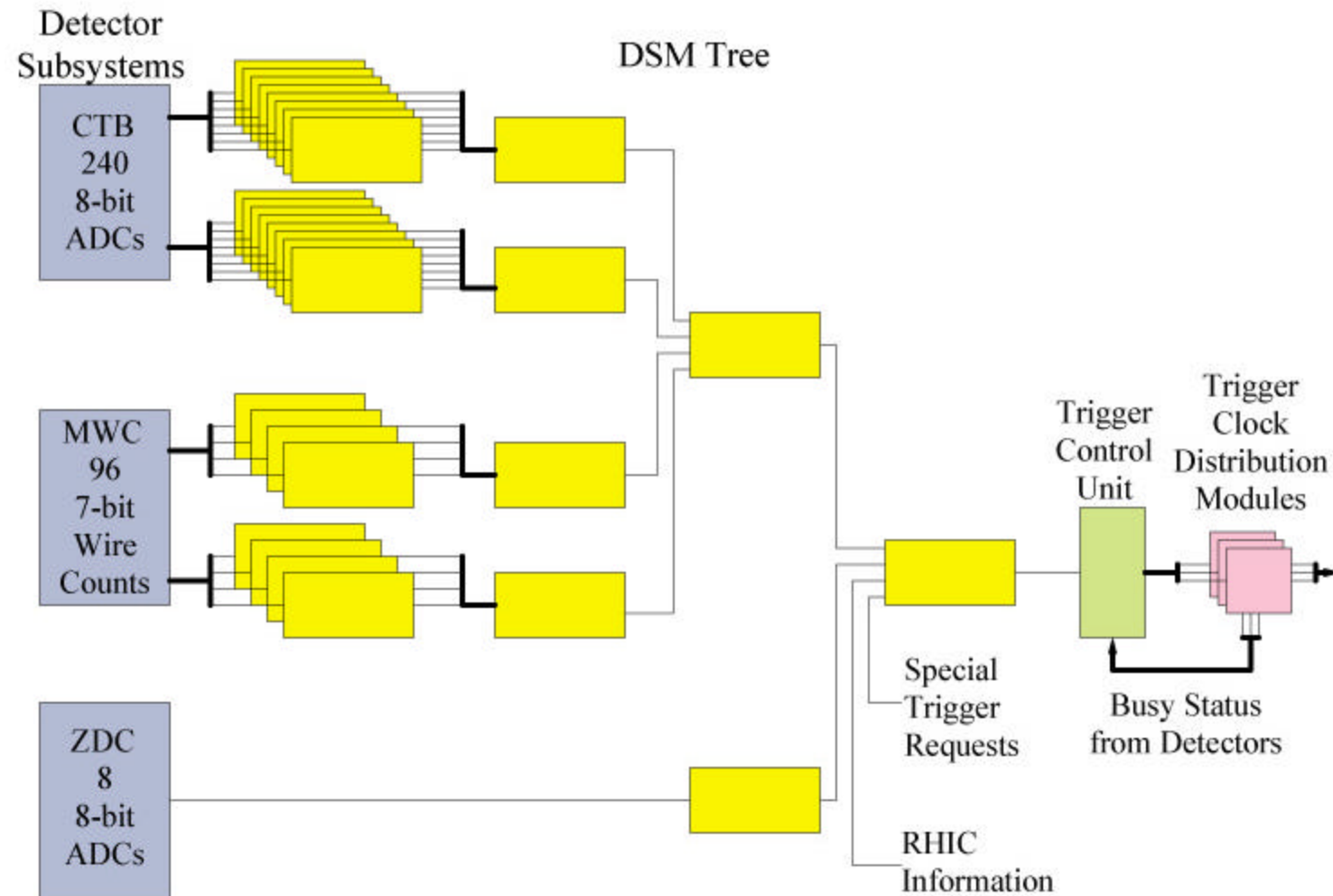


Trigger Implementation

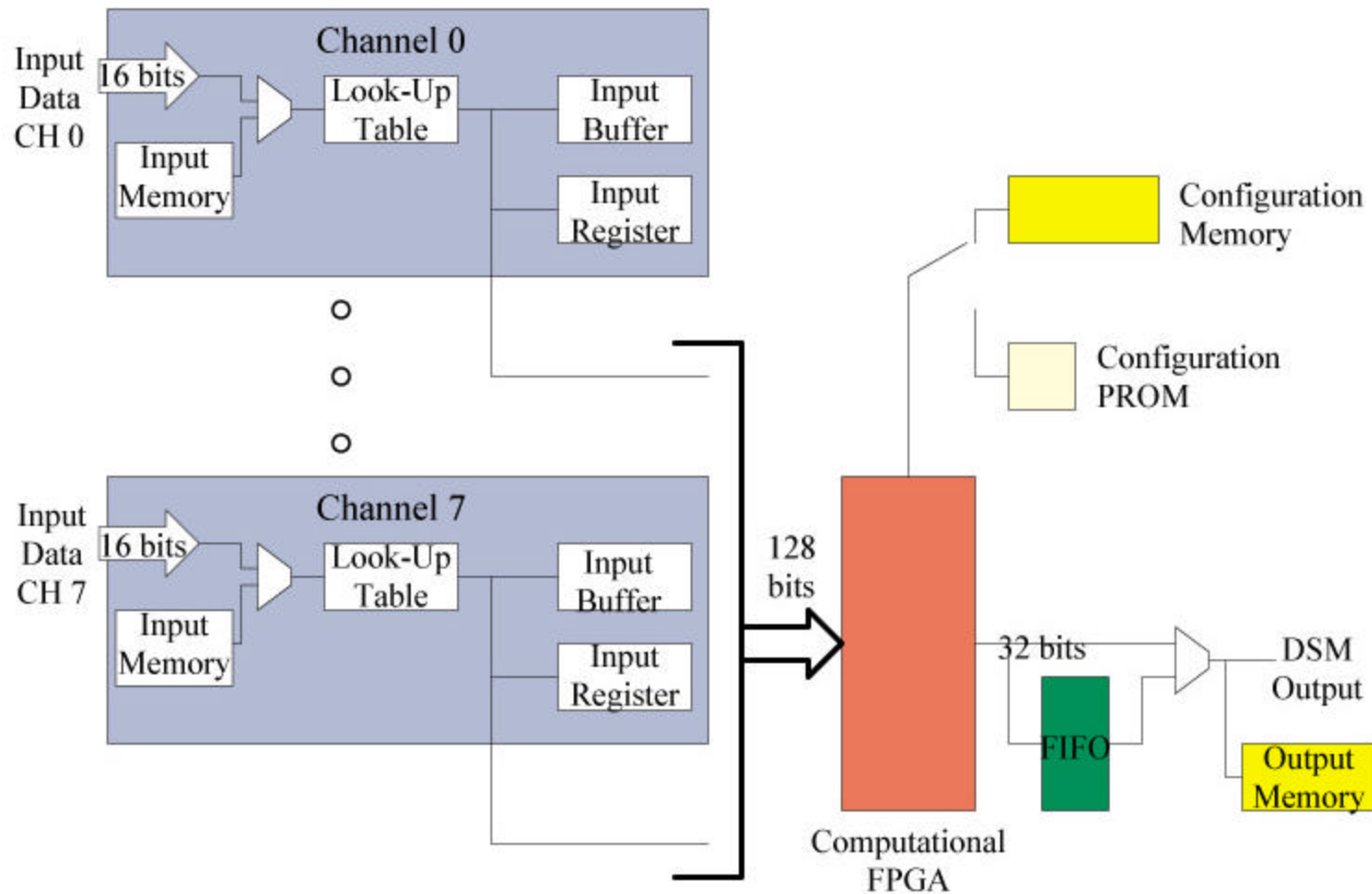


- **Level 0 – Initial Event Acceptance**
 - **Pipelined Synchronous Digital System**
 - Every time the RHIC clock ticks, new trigger data is digitized.
 - Existing data moves to the next layer in the pipeline.
 - **Four layers of data analysis.**
 - Sum all ADC values to calculate total multiplicity.
 - Compare total multiplicity and ZDC signals to thresholds.
 - **Final layer – Decision Time**
 - Combine final physics information with detector LIVE/BUSY status and issue triggers.
- **Levels 1 and 2 – Abort Accepted Events**
 - While an event is being digitized (TPC takes 5 ms) re-analyze trigger data to see if event should be kept or aborted.

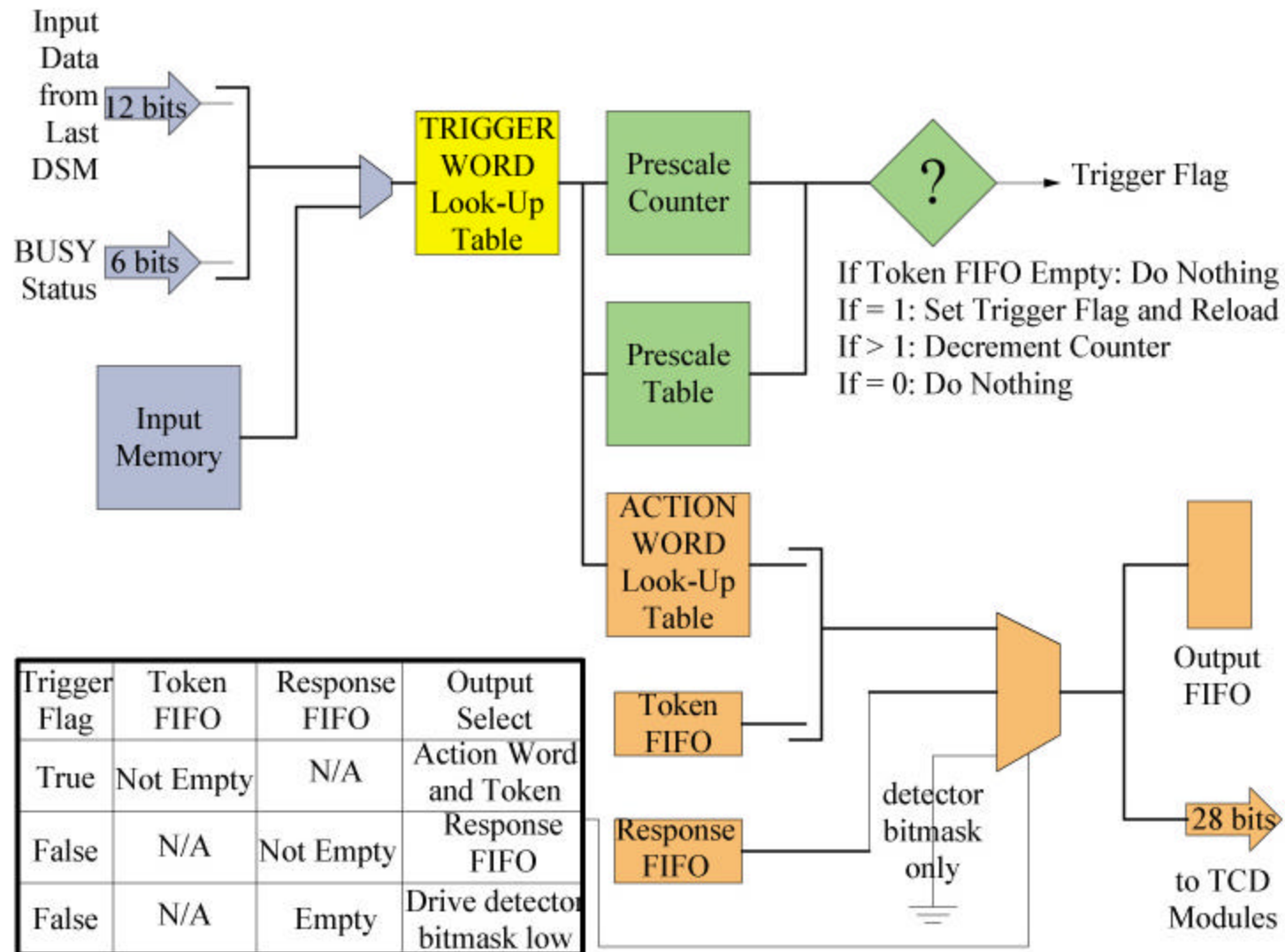
Level 0 Analysis Tree



DSM Board



TCU Board



Level 0 Accept/Reject Decision



- TCU makes primary Accept/Reject decision based on detector BUSY status and results of DSM tree calculations.
 - Output of DSM tree:
 - CTB multiplicity ($S(\text{ADC-ped})$) > lowest threshold
 - CTB multiplicity > middle threshold
 - CTB multiplicity > high threshold
 - ZDC East (summed signals) > threshold
 - ZDC West (summed signals) > threshold
 - Blue ring bucket filled
 - Yellow ring bucket filled
 - Detector BUSY status
 - For each detector: FEE Busy OR DAQ Busy

Summer 2000 Triggers



- **“Minimum Bias”**
 - ZDC East and West thresholds set to lower edge of single neutron peak.
 - REQUIRE: Coincidence between ZDC East and West
- **“Central”**
 - CTB Highest threshold set to upper 15%
 - REQUIRE: Minimum Bias + CTB multiplicity over threshold
 - REQUIRE: CTB multiplicity over threshold
- **“Peripheral”**
 - Back-to-Back track pairs show up as one hit on the North side and one on the South side of the CTB
 - REQUIRE: 1 or 2 pairs of back-to-back tracks ONLY

Conclusions



- **STAR Trigger installed with basic functionality for Summer 2000 AuAu Running**
- **Trigger performed well:**
 - Triggered on combinations of ZDC coincidences and a wide range of multiplicities for Central Collisions program
 - Investigated a wide variety of geometrical triggers for the Peripheral Collisions program.
- **Upgrades for next year:**
 - Level 1 and 2 CPU farms for improved rejection